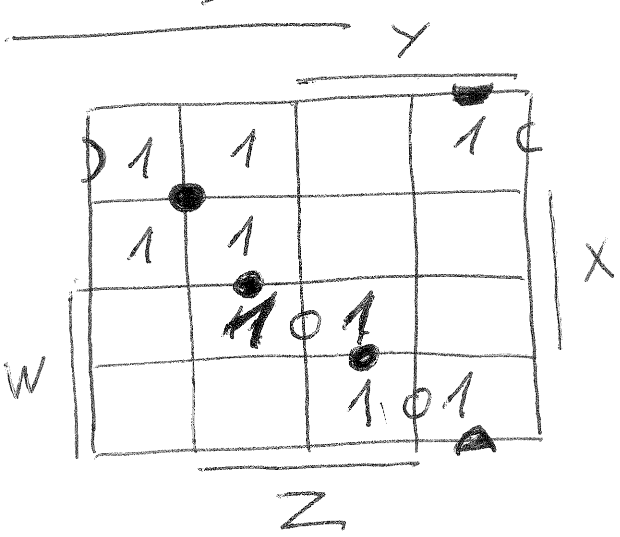
Task I:

Decimal	Binary	Octal	Hex
13.3125	1101.0101	15.24	D.5
167.625	10100111.101	247.5	A7.A
346.75	101011010.110	532.6	15A.C
55204.75	1101011110100100.1100	153644.6	D7A4.C

Task II:



Prime Implicants:

$w'y'$, $w'x'z'$, wxz, wyx',

$xy'z$, wyz, $x'yz'$

Essential PI:

$w'y'$

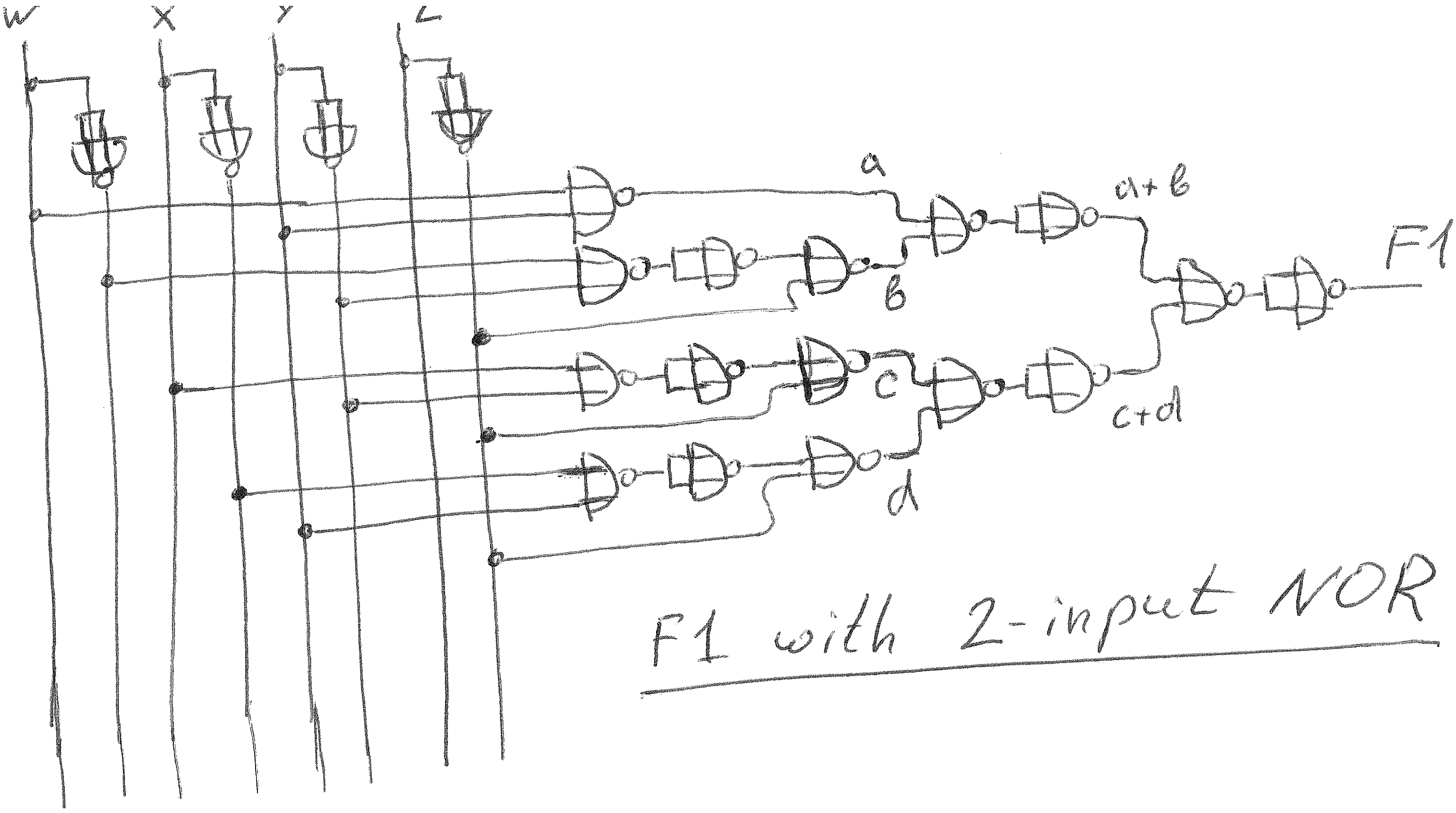
$$F1(w,x,y,z) = w'y' + wyz + x'yz' + xy'z =$$

$$= ((w'y' + wyz + x'yz + xy'z)')' =$$

$$= ((\overline{w'y'} + \overline{wyz} + \overline{x'yz} + \overline{xy'z})')' =$$

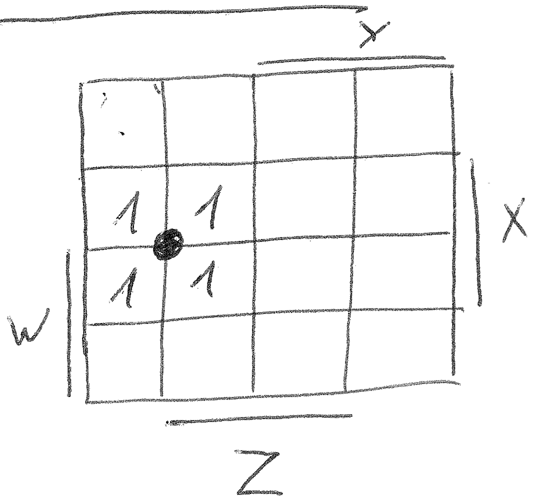
$$= ((\underbrace{\overline{w+y}}_{a} + \underbrace{\overline{w'+y'+z'}}_{b} + \underbrace{\overline{x+y'+z'}}_{c} + \underbrace{\overline{x'+y+z'}}_{d})')'$$

Basis NOR



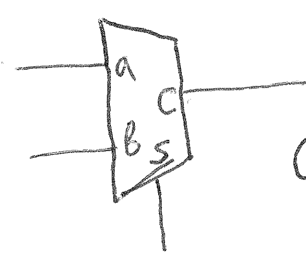
F1 with 2-input NOR

Task III :



$F2(w, x, y, z) = x y'$

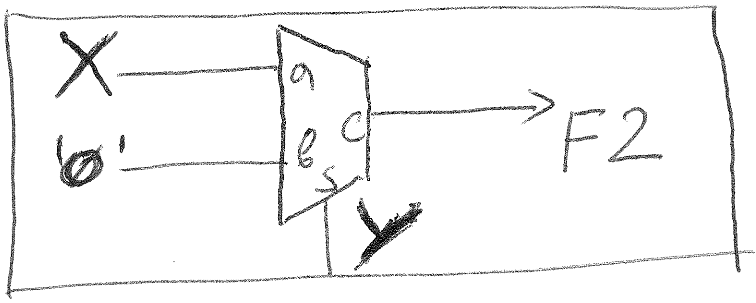
Mux 2-to-1 is:



$c = s'a + sb$

if $s = y$ and $a = x$ and $b = 0$ =>

=> $c = y' \cdot x + y \cdot 0 =$ $\boxed{x y' = F2}$, thus



Simplest circuit with only 1 MUX

Task IV:

①. We identify 4 states as follows:

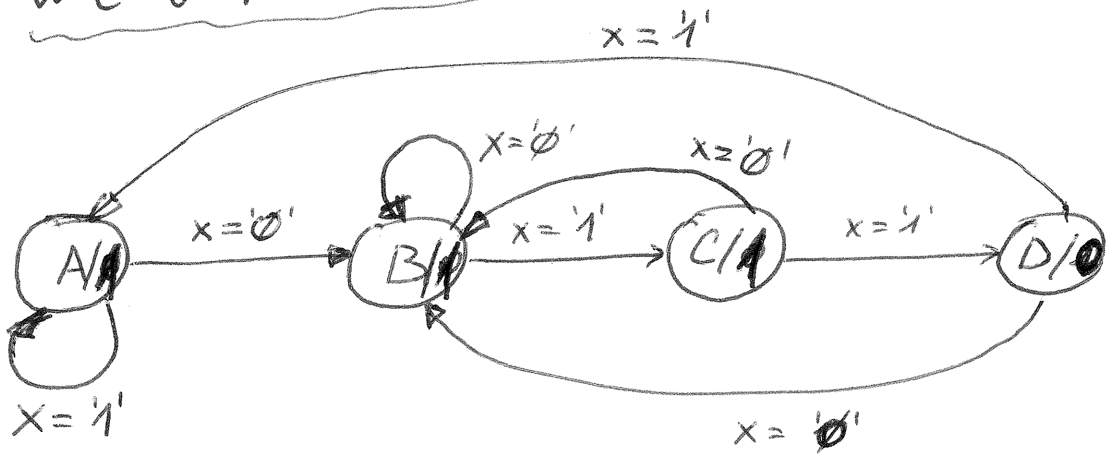
A : nothing from ~~input~~ sequence found;

B : "Ø" from the sequence found;

C : "Ø1" from the sequence found;

D : "Ø11" the sequence is found;

②. We derive the Moore FSM state diagram:



③. We derive the Moore FSM state table:

X	Present state	Next STATE	Z
0	A	B	1
1	A	A	1
0	B	B	1
1	B	C	1
0	C	B	1
1	C	D	1
0	D	B	Ø
1	D	A	Ø

4. We code the states as follows:

	Q_1	Q_2
A	0	0
B	0	1
C	1	0
D	1	1

A is the initial state = "ØØ"

5. We derive the encoded state table:

$X(t)$	$Q_1(t)$	$Q_2(t)$	$Q_1(t+1)$	$Q_2(t+1)$	$Z(t)$
0	0	0	0	1	1
1	0	0	0	0	1
0	0	1	0	1	1
1	0	1	1	0	1
0	1	0	0	1	1
1	1	0	1	1	1
0	1	1	0	1	Ø
1	1	1	0	0	Ø

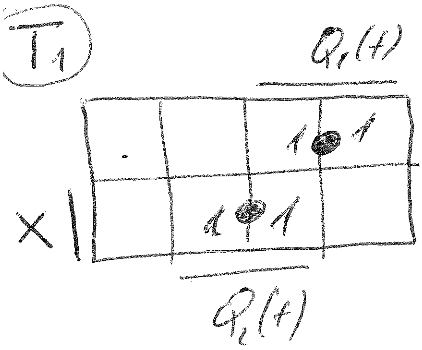
$\Longrightarrow$ Order the Table

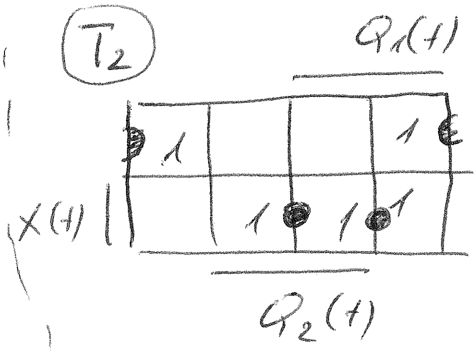
$X(t)$	$Q_1(t)$	$Q_2(t)$	$Q_1(t+1)$	$Q_2(t+1)$	$Z(t)$
0	0	0	0	1	1
0	0	1	0	1	1
0	1	0	0	1	1
0	1	1	0	1	0
1	0	0	0	0	1
1	0	1	1	0	1
1	1	0	1	1	1
1	1	1	0	0	0

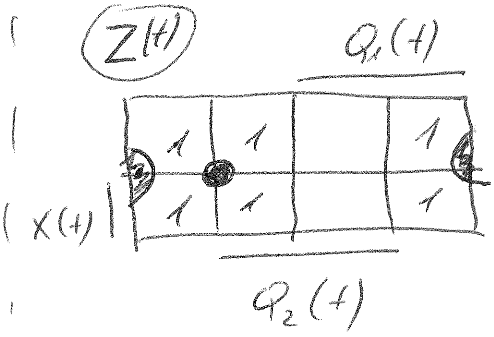
6. We derive the state table using T flip-flops:

$x(t)$	$Q_1(t)$	$Q_2(t)$	$Q_1(t+1)$	$Q_2(t+1)$	T_1	T_2	$Z(t)$
0	0	0	0	1	0	1	1
0	0	1	0	1	0	0	1
0	1	0	0	1	1	1	1
0	1	1	0	1	1	0	0
1	0	0	0	0	0	0	1
1	0	1	1	0	1	1	1
1	1	0	1	1	0	1	1
1	1	1	0	0	1	1	0

7. Derive and simplify the equations:







$T_1 = x'(t) \cdot Q_1(t) + x(t)\, Q_2(t)$

$T_2 = x'(t)\, Q_2'(t) + x(t)\, Q_2(t) + x(t)\, Q_1(t)$

$Z(t) = Q_1'(t) + Q_2'(t)$

BASIS NAND:

$$T_1 = \overline{\overline{x'(t) \cdot Q_1(t) + x(t)\, Q_2(t)}} = \overline{\overline{x'(t) \cdot Q_1(t)} \cdot \overline{x(t) \cdot Q_2(t)}}$$

$$T_2 = \overline{\overline{x'(t) \cdot Q_2'(t)} \cdot \overline{x(t) \cdot Q_2(t)} \cdot \overline{x(t) \cdot Q_1(t)}}$$

$$Z(t) = \overline{\overline{Q_1'(t) + Q_2'(t)}} = \overline{Q_1(t) \cdot Q_2(t)}$$

8. We draw the circuit: